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ABSTRACT

This document summarizes the accomplishments of the first year of the Cornell Youth Apprenticeship Demonstration Project in Broome County, New York, a program in which six high schools and six employers in the Binghamton area have joined forces to prepare noncollege-bound young people for careers in manufacturing and engineering technology, administration and office technology, or health care. The first of the document's three sections provides an overview of the program, which placed 40 students in apprenticeships between fall 1991 and fall 1992, as well as discussions of the program's participating employers, schools, and parents and their motives for participation. Section 2 is an overview of research on the following topics related to creating the infrastructure for youth apprenticeship: learning objectives/competencies; work-based curricula; apprenticeship progress reports; teaching and learning at work; career pathways; school-based curricula; and the institutional base of apprenticeship. In section 3, the role of youth apprenticeship as a means of preparing students to perform all tasks within a broadly defined occupational area is emphasized and discussed in relation to the health care, office occupations, administration/office technology, and manufacturing/engineering technology fields. Sample instruments used by the project employers to evaluate apprentices' progress are included. (MN)

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YOUTH AND
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PROGRAM

PREPARING YOUTH FOR THE FUTURE

Toward a Youth Apprenticeship System

A Progress Report from the Youth Apprenticeship Demonstration Project in Broome County, New York

Mary Agnes Hamilton
Stephen F. Hamilton

January 1993

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Far too many people have participated in the development of this project to make a comprehensive list possible. We include, therefore, only people who have worked with us as staff or students. Foremost in that group is Benjamin J. Wood, who, with Penny Corino, has ably constructed a firm foundation for the project in Broome County. We owe sincere thanks as well to Sue Baer, Jeff Claus, Nell Eppinger, Mary Ann Erikson, Renée Ferrari, Sherlyn Frank, Fiona McInally, Pamela Moss, Starr Niego, Lynn Okagaki, Elizabeth Rowe, Margaret Wiebold, Felicia Wiener, and Suet Wu.

Participating Employers

Anitec, Imaging Products Division of International Paper Corporation (joined 1992)
IBM Corporation at Endicott (joined 1992)
Lourdes Hospital
The Raymond Corporation
Security Mutual Life Insurance Company of New York
United Health Services Hospitals: Binghamton General Hospital, Wilson Medical Center

Participating Schools

Binghamton High School
Greene High School
Susquehanna Valley High School
Union–Endicott High School
Whitney Point High School
Windsor High School (joined 1992)

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Cornell's Youth Apprenticeship Demonstration Project located in and around the city of Binghamton, New York, has two major objectives:

- To create an enduring program that will enable participants to move from adolescence into adulthood as productive workers, active citizens, and caring family members.
- To foster the creation of a nationwide system that will achieve these purposes for all young people who do not graduate from four-year colleges.

Three closely related functions contribute to these objectives: *developing* the program, tending to its daily *operation*, and conducting *research*. Research done in Europe and the United States led to the project's initiation.[1] Cornell University retains direction of the project to facilitate continuing research and program development. Research guides and enriches program development and day-to-day operations in addition to informing people outside the project about what we have learned.

To gain a full understanding of how youth apprenticeship can work in the United States, staff at Cornell have remained intimately involved in the demonstration project. The ultimate goal, however, is not only to create programs but to create a comprehensive school-to-work transition system, which is lacking only in the United States among industrial powers.

This report identifies issues encountered during the program's first year of operation and describes how they have been dealt with. It is not a manual, but practitioners and policy makers may find in it ideas about how to design and operate programs.

The Apprenticeship Program

The first apprentices were enrolled in the Cornell program during the fall of 1991. Twenty-two juniors from five high schools were placed with four employers. Twenty completed the school year satisfactorily and enrolled for their second year in the fall of 1992. Twenty new apprenticeships have been created for juniors in 1992–93. One new high school and two new employers have joined the project. Table 1 summarizes the occupational areas covered by the current apprenticeships. (Four of the twenty new apprenticeships will be filled in January 1993.)

Table 1. Apprenticeships in Broome County, New York

September 1992

Occupational Area	*Number of Apprenticeships*
Manufacturing and Engineering Technology	12
Administration and Office Technology	13
Health Care	15
Total	40

1. See *Apprenticeship for Adulthood: Preparing Youth for the Future* by Stephen F. Hamilton (New York: Free Press, 1990) and "Teaching and Learning on the Job: The Pedagogy of Apprenticeship" by Stephen F. Hamilton and Mary Agnes Hamilton (unpublished manuscript, Cornell Youth and Work Program, July 1990). An updated summary of this latter study appears in James E. Rosenbaum, ed., *Youth Apprenticeship in America: Guidelines for Building an Effective System* (Washington, D.C.: William T. Grant Foundation Commission on Youth and America's Future, 1992).

The three occupational categories in which apprenticeships have been created—manufacturing and engineering technology, administration and office technology, and health care—were chosen because they are all projected to grow substantially, both in the country as a whole and in the region. All three include a range of occupational titles associated with post–high school education and training but not requiring a baccalaureate degree. They span predominantly male, predominantly female, and mixed-gender occupations, attracting conventionally oriented youth and allowing others to learn occupations associated with the other gender.

The program design was inspired by youth apprenticeship in Germany and other European countries. It enables young people to combine school with carefully planned and supervised work experience over a four-year period, including two years of community college. At completion, they will have acquired a high school diploma, an associate's degree, and expert job skills derived from extensive work experience. We hope the program will ultimately qualify for registration with the New York State Department of Labor; then it will also provide nationally recognized skill certificates.

Both the four-year duration of the program and formal registration are goals that have not yet been achieved. Our program development strategy has been to engage young people, schools, and employers as quickly as possible and then to try to formalize the process that emerges. The project can be characterized as a "bottom-up" approach, in contrast to efforts in some states (e.g., Wisconsin, Oregon, Illinois) to create a youth apprenticeship system from the "top down." Because we did not know when we began just how any of our apprenticeships would work out over a four-year period, seeking registration seemed premature. Our use of the term "apprenticeship" indicates our firm intention to meet the definition propounded by the Federal Committee on Apprenticeship.[2]

During the developmental phase, Cornell staff retain primary responsibility for designing and implementing the project. The structure and practices of the program described in this report resulted from their efforts. Benjamin Wood, who is located in Broome County's Cooperative Extension office (one hour's drive from Cornell), coordinates the project locally; he convenes the steering committee, works with the schools on recruiting and scheduling, and helps connect employers with school staff to solve problems.[3]

The aim is to recruit middle students, young people who probably would not enroll in college without an extra boost but who do not have severe academic or behavioral problems. We expect that as it matures the program will become better able to accommodate young people who face greater risks. First-year apprentices' grade point averages (GPA) indicate that middle students were successfully recruited. The modal GPA was C. The mean was B– (80.4). Most students were enrolled in regents courses, the level between basic and honors. Some, however, are honors students, and some have below average school performance, demonstrating that the program is appropriate for most students. Half of the first-year apprentices reported that the highest level of education achieved by either parent was high school graduation. Only four had a parent with four or more years of college. Racially, apprentices reflect the county's population, which is 4.4 percent nonwhite.

Participants and Their Motives

Employers

Employers participating in the project have described their motives as a combination of self-interest, concern about the quality of the work force in the region, and civic responsibility. They hope apprentices will eventually become their own skilled workers, meeting a need they anticipate. The depth of their commitment is indicated by their willingness to assume the costs of paying apprentices and of training and supervising them. They are also realistic enough to know that young people may not complete a four-year program and that, if they do, they might choose to work for another employer. They believe, however, that the training they provide will benefit other employers and the apprentices, and they are willing to expend resources without the guarantee of a direct return.

2. The Federal Committee on Apprenticeship, which advises the U.S. Department of Labor, is one of several groups in which some representatives of organized labor have expressed opposition to the use of the term "apprenticeship" outside of the registered craft apprenticeships that now exist in the United States. This opposition stems from justifiable pride in an effective system and from fear that any broadened usage will erode that system and organized labor's key role in it. But it also reflects a common belief in the United States that teenagers are incapable of learning advanced skills and performing as journeyworkers. European experience decisively refutes this belief. Our vision of youth apprenticeship is wholly consistent with the Federal Committee on Apprenticeship's definition, but it applies to occupations that are not now apprenticeable and incorporates groups that are underrepresented in traditional programs. It also makes stronger connections between school and work than does traditional U.S. apprenticeship. Completion of most traditional apprenticeships is based largely on hours served, whereas youth apprentices earn their credentials by demonstrating the competencies they have acquired.

3. *Creating Apprenticeship Opportunities for Youth*, the 1991 progress report, contains more information about the structure, roles, and responsibilities within the project.

Securing employers' participation is the most challenging aspect of our project and of youth apprenticeship generally. Unlike school-based approaches to learning, youth apprenticeship absolutely requires the participation of employers. Without large numbers of committed employers, youth apprenticeship will remain a small program at best. Altruism, though a component of that commitment, will never be sufficient to motivate widespread participation.

Germany and other European nations can maintain large youth apprenticeship systems because they are motivated by conditions, institutions, and structures that do not yet exist in the United States. For example, German labor unions and youth are willing to accept low apprenticeship wages, limiting employers' costs. German employers produce and sell high-quality goods and services that require a highly skilled work force and command premium prices, a product-market strategy that enables them to pay high wages and training costs. German labor markets are predominantly internal in the sense that workers tend to stay with one employer and move up rather than switching employers (entering the external labor market), enabling firms to recoup their investment in training apprentices. The German government pays many of the costs of developing and maintaining the system, such as those for creating curriculum and setting standards. Chambers—associations that all employers are required to join—spread the other costs equally. Because apprenticeship is so widespread, training firms need not fear losing all their apprentices to other firms; they can easily replace those that are lost with workers trained elsewhere.

In a small demonstration project like ours, employers are recruited individually. But for youth apprenticeship to grow, employers must act collectively, agreeing to provide a given number of training slots and setting some uniform standards for what apprentices will do and the competencies they must acquire.

Schools

Schools participate because they believe apprenticeship will benefit their students. They gain educational resources that employers provide. Costs for program development, staff training, and coordination are assumed by the Cornell Youth and Work Program, which also conducts research and development. But each school must assign staff to work on the project and pay for special arrangements from its regular budget. The level of commitment by schools is remarkable in view of the straitened circumstances they face.

Because the purposes of the project align with their own, schools have been much easier to recruit than employers. Nearly every school system in the region has expressed willingness to participate. If youth apprenticeship grows, however, so will the demands on schools.

The most onerous demand on school staff is for flexibility in scheduling students. Providing sufficient time for a significant work experience while assuring that all students take the courses they need is a great challenge, especially in smaller schools that do not have multiple offerings of the same classes. Because employers are usually unable to plan apprenticeships far in advance, scheduling has typically created problems. A second consideration, beyond making time for work experience in apprentices' schedules, is strengthening their academic connections to the occupations, for example, by registering them in advanced courses in science, math, electronics, and accounting.

Parents

Parents are informed about the project as part of the student recruitment process. Ordinarily they are invited to an informational meeting before students fill out applications. They must agree to their children's participation and affirm their understanding of the program, including the research component. Interviews with parents revealed that they support it strongly. Their only recommendation is that it should serve more young people.

The concern most frequently expressed by parents is that participation might jeopardize their child's chances of going to college. It is the rare parent of a high school sophomore who does not believe his or her child can and should go to college. The project incorporates two years of community college, which allays this concern for most parents.

It is important to keep parents informed about what apprentices are doing at work. The training director of a Swiss manufacturing firm described apprenticeship as relying equally on workplace, school, and family. He required applicants to bring their parents for interviews and parents of apprentices to visit the plant before the end of the three-month trial period. This level of parent involvement makes sense in view of apprentices' youthfulness, but it is not a familiar practice for American employers. Most of the employers in our project hire workers who are independent adults. Therefore, we have had to set up communication lines between employers and parents as well as between employers and schools. The local project coordinator, Ben Wood, has been essential to facilitating such communication.

Some firms have invited parents to participate in their orientations for new apprentices. Parents also serve on the committees that guide the project in each school. Additional communication is maintained through a newsletter, the *Apprentice's Almanac,* social gatherings such as a supper or a picnic, and telephone interviews.

Research Data

School Performance Records

Course selection, grades, attendance, national test scores, extracurricular activities, discipline

Surveys

Time use, educational expectations, self-perception

[regarding scholastic competence, job competence, global self-worth, social acceptance, close friendships, and adult relationships]

Work values, learning from work, usefulness of work experience, job stress

Family background

Apprentice Progress Reports

Coaches' ratings of apprentices on nine competencies

Interviews of Apprentices

Perceptions of work, apprenticeship, school, self, and their future

Interviews of Parents

Perceptions of the program and their child's progress

Interviews of Coaches, Mentors, and Managers

Perceptions of their role in the program, program development, and their future

Observations

Key incidents that illustrate how teaching and learning occur in the workplace

Portfolios

Collections of progress reports, journals, projects, work schedules, and work products

Research Overview

Interviews and ethnographic observations of apprentices at work are key research methods. In addition to yielding field notes that are later coded and analyzed for use in research reports, observations and interviews give project staff access to information that is critical to the program's operations and enable them to work as consultants with apprentices and their adult instructors. Being simultaneously participant and observer carries some risks, but that dual role has proved exceptionally valuable in strengthening the program.

Monitoring the impact of the program is central to the project's research and development purposes. As the program develops and the research becomes more narrowly focused, we will attempt to assess the impact of apprenticeship on young people's development, broadly defined. Much of our work at this stage involves the identification of key variables to guide development of instruments for continued data collection and to generate and refine hypotheses for testing by further research and program development.

The key question guiding our research is not whether youth apprenticeship works, but how it works. We want to learn under what conditions and for which youth apprenticeship works best. That is, we want to examine the conditions that contribute to good apprenticeships generally, but we also expect that characteristics of individual apprentices will interact with environmental conditions to make some contexts better for some individuals. The major goal of our research is to explore how teaching and learning occur informally in workplaces.

The multiple data sources listed in the box to the left serve primarily to monitor and document the way the project functions. Measuring its outcomes will be more useful after the

project is better established and apprentices have spent more time in it. Preliminary analyses of data collected to date suggest that participation has a positive effect on their selection of career pathways, development of social and technical competencies related to the workplace, and acquisition of self-confidence.

The apprenticeship experience also expands the number of adults young people feel close to. At the end of their first year in the project, ten of the twenty apprentices reported that adults in their workplaces were among the five most important adults in their lives. It is important to note, however, that these adults did not replace apprentices' parents.

Creating the Infrastructure for Youth Apprenticeship

Learning Objectives: Competencies

Following the lead of British sociologists who describe workplaces as sociotechnical systems, we have identified social as well as technical competencies that apprentices should learn. This combination also reflects background research revealing that how well neophyte workers understood and operated within the social system of their workplace was at least as important to their success as how well they could perform technical tasks. It is also consistent with the message of the Secretary's Commission on Achieving Necessary Skills (SCANS) and other recent reports detailing the demands of high-performance workplaces.

Social competencies (see the box to the right, above) are generic; they apply equally in all the workplaces where apprentices are located. Most technical competencies are specific to a particular occupation, even a particular firm. The first three categories of technical competencies—procedures, computer use, and principles—are the most specific. The fourth—commitment to excellence—is generic.

Competencies: Learning Objectives for Youth Apprenticeship

Technical Competencies: Perform Work Tasks

1. Procedures: Follow steps to accomplish a task.
2. Computer use: Use computer technology efficiently and effectively.
3. Principles: Understand reasons for procedures.
4. Excellence: Commit to high standards of practice and to continuous improvement.

Social Competencies: Participate in an Organization

5. Systems: Understand the organizational context.
6. Rules: Adhere to professional norms.
7. Teamwork: Cooperate with others in a variety of roles.
8. Communication: Use written and spoken language to give and receive clear messages.
9. Responsibility: Act independently when appropriate; take initiative for work and learning.

To make apprenticeship viable for large numbers of young people and in many firms, we are working to enlarge the domain of generic competencies. If each firm and occupation requires a separate apprenticeship, curriculum development and certification will be prohibitively expensive. Furthermore, apprentices will be constrained in their career choices because training in one firm or occupation will not transfer to another.

Participating firms are beginning to identify a common core of learning, which we hope eventually to group as modules incorporating similar procedures such as those used in a variety of laboratories or departments. We are also beginning to sort learning objectives according to which are better accomplished through firsthand experience in the workplace, through related learning in a classroom, or through ad hoc group instruction.

Work-Based Curricula

A curriculum identifies and justifies a set of learning objectives and the instructional activities designed to achieve them. It also indicates how the achievement of those objectives will be assessed. Curricular issues arise both at school and in the workplace. Our project has emphasized learning at work because less is known about that topic than about learning at school. This emphasis also

matches the design of the project because apprentices are in too many different schools and occupations to justify a specialized school-based curriculum.[4]

Sweden, borrowing from Danish adult education, has organized secondary vocational education into modules for each occupational area. A module incorporates the knowledge and skills associated with one aspect of an occupation (e.g., building trusses for construction). Unlike the German system, in which apprentices receive blanket certification for all the competencies specified for an occupation, Swedish vocational students indicate their competencies to a prospective employer by showing precisely which modules they have completed. Modules are more flexible than blanket certification. They can be selected and combined to meet any number of specialized needs. They can be earned at any time and location. An employer might hire a vocational graduate and then require the person to complete additional modules as an apprentice to become fully qualified. Slow learners might leave high school after completing only a few modules but still have occupational credentials. Faster learners graduate with a more impressive collection of modules.

We hope eventually to develop equally systematic curricula. Doing so will require substantial human resources and extensive participation from employers, educators, and worker representatives. Universally accepted work-based curricula will require commitment to youth apprenticeship by a substantial segment of employers in a given field on a statewide basis, if not nationwide.

In the meantime, we are continuing to refine competencies to develop apprenticeship programs that are comparable even when they are sponsored by different employers. We start with the needs and learning opportunities provided by willing employers. Department managers first describe tasks that an apprentice will perform and then list competencies related to those tasks. Because managers naturally begin with technical procedures, computer use, and principles, and because the other competencies are generic, we now invite managers to concentrate on identifying tasks related to the first three competencies and we now supply them with the list of generic competencies. Together, these form the core of a learning plan within a department. This initial core is tendered as a draft; the learning plan is modified as managers gain experience with apprentices, and it is adapted to individual apprentices' speed of learning and the length of time they spend in the apprenticeship. (In their first placements, apprentices learn not only new technical procedures but also many social competencies such as the rules of the workplace and ways to communicate. As they acquire generic competencies, they learn specific competencies more quickly.)

A set of departmental plans states what an apprentice will learn. Ultimately, like the competencies, learning plans must be established from the top down. Currently, apprentices are placed in departments whose managers choose to accept them. This is a sensible start-up strategy but cannot be sustained on a large scale. Employers must decide what they want apprentices to learn and then place apprentices wherever they can acquire specified competencies.

Apprentice Progress Report

The most useful work-based curriculum tool we have devised thus far is the Apprentice Progress Report. Originally this report was intended as a tool to document what apprentices had learned and to communicate that learning to the apprentices and managers in other departments. Now it also serves to identify in advance what an apprentice will learn in a given department. It also enables employers and researchers to assess the learning plan within each department as well as across an apprenticeship program within and among firms. This document enhances discussions about employers' vision of the future and their needs for future workers. This year, employers agreed to share the progress reports with schools to substantiate the award of academic credit to apprentices.

4. Fortunately, European approaches provide useful models for organizing learning in the workplace. For example, the Swiss *Modellehrgang* (model apprenticeship or pattern of instruction) is organized by sections. Each section specifies work that must be accomplished, sometimes defined by professional standards (e.g., machine within a tolerance of IT7 and surface finish of N7) and theory (e.g., safety precautions, hardened metals, machine maintenance). Some sections (e.g., service shop) run several pages and are subdivided (lathe, drilling, machining, CNC, assembly), each subsection having all the elements of other whole sections. Some sections include more than one occupation (e.g., machinist and machine repairer). The model or pattern establishes national standards for what apprentices will do and learn. Each firm then adds to the pattern its own needs and opportunities to create a customized plan for its apprentices.

Apprentice Progress Report 1992–93

ANITEC

Apprenticeship: ***Manufacturing and Engineering Technology***

Evaluating Department: ___ ***Research and Development***

Apprentice _____ Evaluator _____

Evaluated period is _____ through _____

Date _____

Directions

1. **Evaluate.** Circle the response that best communicates the apprentice's competence at the time of the rating.

   Satisfactory Progress The apprentice *has met* the learning objectives for this stage in the apprenticeship.

   Unsatisfactory Progress The apprentice *has not met* the learning objectives for this stage in the apprenticeship.

   Not Applicable This was not a learning objective, or there was no opportunity for progress.

2. **Add competencies.** Add specific competencies the apprentice has been developing during this placement that are not listed.

3. **Comment.** At the end of each section, there is space for you to comment on the apprentice's progress. Note in that space outstanding achievement, problems, or other special remarks.

4. **Discuss.** After completing the report, discuss it with the apprentice. Both the evaluator and apprentice should sign it.

5. **Mail.** Please send copies of the Progress Report to the apprentice's school coordinator and to Cornell.

6. **File.** Please add this original and work samples to the apprentice's portfolio.

Apprentice's signature _____ *Evaluator's signature* _____

Youth Apprenticeship Demonstration Project
Cornell Cooperative Extension
November 11, 1992

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Understand work tasks

1. **Procedures: Follow steps to accomplish a task**	S	U	NA
Manufacturing and Engineering Technology:			
1.1 Organize work tasks			
a. Determine job priorities			
Research and Development:			
1.2 Measure Static Protection			
a. Obtain/prepare unprocessed film strips			
b. Condition strips at a given humidity			
c. Use charge decay or surface resistivity meter to determine the measurement			
d. Plot, graph, or tabulate data for the series of experiments			
e. Process film strips through an automatic processing line and repeat steps 2–5			
f. Determine the difference processing has on static properties			
1.3 Prepare Transmission Electron Microscopy Emulsion Sample			
a. Melt emulsion or remove from coated substrate			
b. Prepare emulsion chemically for slide application			
c. Carbon evaporate onto slide to produce a carbon replicate			
d. Prepare carbon replicate for viewing on TEM			
e. Copy onto photographic film or collect image on PGT Imagist System			
1.4 Perform PGT Image Analysis (using computer system)			
a. Collect images from either TEM or photographic film negatives			
b. Treat data with particle analysis software			
c. Output pictoral/graphic/calculated data			
1.5 Perform Scanning Electron Microscopy			
a. Prepare samples—mounting/sputter coating			
b. SEM examine and provide Polaroid micrograph			
1.6 Perform Optical Microscopy			
a. Prepare sample for defect analysis and photomicrography			
b. Identify compositions of small particles			
c. Prepare cross section of films and papers			
d. Identify and measure coated layers			
e. Polarize light microscopy and microchemical tests used to identify defects			

	S	U	NA
1.7 Perform Image Analysis			
a. Use computerized image analysis hardware/software			
b. Analyze various defects in photographic and papers			
c. Analyze test results used for improving the quality of the films and papers			
1.8 Perform Particle Size Analysis			
a. Prepare sample: • liquify emulsions • measure solutions • sonicate samples			
b. Select proper parameters for particle size measurement (maximum, minimum, diameter divisions, dispersion density, dispersion viscosity, and sample density)			
c. Interpret results of the analysis			
d. Report results of the analysis			
1.9 Perform Paper Base Development—(Initial physical testing of photographic papers)			
a. Request specific tests to be performed			
b. Request the reasons for each test			
c. Cut samples to specific sizes			
d. Interpret results of the test			
e. List and summarize data in report form			
Comments:			

Teaching and Learning at Work

Designing and Managing Work Experience

An apprentice's learning experience begins with a manager's list of the tasks to be performed and competencies to be acquired, but the success of an apprenticeship is determined primarily by the quality of teaching on the job and by the apprentice's willingness to take responsibility for learning. The following pages convey what we have learned about the conditions that foster effective teaching and learning in workplaces.

How Employers Design and Manage Apprenticeships

Identify tasks and the competencies needed. Managers name tasks that enable apprentices to learn how to do the work in a department. Apprentices make progress in nine competencies, including both technical and social skills.

Sequence tasks. New tasks are introduced to apprentices in a logical order so that the skills and knowledge required for each lay the foundation for mastering the new skills and knowledge required for the next tasks.

Assign coaches. Managers may coach apprentices in performing work tasks, but greater efficiency and breadth are achieved by delegating coaching to several employees within a department. Adults who coach apprentices should be sensitive to and interested in youth, and they should understand the program. Coaches must grasp the principles underlying the apprenticeship program. They must also be competent workers.

Coordinate educational experiences across departments. As apprentices rotate through different departments within a firm, they should receive a comprehensive picture of their occupational area and firm and gain skills they will need as workers in the future. Coordinating educational experiences also requires monitoring what the apprentice is learning to make sure that both procedures and principles continue to provide challenges.

Maintain communication with parents and school contacts. To keep people informed about the apprentice's experiences, employers identify contact people within the firm for parents and school staff to call if they have questions and concerns and address concerns as they arise.

Maintain records of the apprenticeship. Records should document what the apprentice is learning and keep track of her or his rotation through departments.

Employers must designate training directors to design and manage apprentices' learning, among other functions. One person must be responsible for overseeing all aspects of the program, including recruitment, apprenticeship development (new departments, learning objectives within departments, future vision of workers in departments, staff development within the firm for apprenticeship), group instruction for apprentices (e.g., about safety), and evaluations of apprentices. The training director is also the prime link to schools. When particular problems arise (e.g., the need for a course, inappropriate behavior, irregular attendance, scheduling difficulties), the training director works with the apprentice, parents, and school staff to resolve them.

Preliminary research in Germany and the United States focused our attention on the roles of instructors and learners in the workplace. On the basis of this research, we have developed a framework that guides the design of both the demonstration project and our continued research. This section describes and illustrates that framework.

Coaching Apprentices

We call direct teaching of apprentices "coaching" and "mentoring." Coaching refers to teaching apprentices about their work tasks and job responsibilities. Coaching includes the instructional behaviors described in the section "How Employers Coach Apprentices to Perform Work Tasks" on this page. We work with coaches to teach and support them in this style of teaching. Our research will test the hypothesis that such teaching assists apprentices in learning.

How Employers Coach Apprentices to Perform Work Tasks

Demonstrate task performance by doing the task while the apprentice observes. While performing the task, the coach points out important features and checks the apprentice's understanding by asking questions and encouraging the apprentice to ask questions. (Reciprocal questioning is also part of the other functions.)

Explain how to perform a task correctly. Explanation may accompany demonstration or be provided separately. It sets out performance criteria, points out what problems are likely to occur, and identifies possible problem-solving strategies.

Explain why a task is performed a certain way. A coach must explain why the task is performed according to certain specifications, provide information about the business management or scientific principles underlying the procedure, and explain how the task relates to other tasks.

Monitor and critique the apprentice's attempts to do the task. While monitoring the apprentice's performance, the coach gives clear and immediate feedback. Although monitoring and feedback are continual, the interval between instances increases as the apprentice gains competence, and the coach encourages the apprentice to monitor his or her own performance and to seek help when difficulties arise.

Model problem solving by thinking aloud and demonstrating problem-solving strategies. Modeling includes explaining what questions the apprentice can ask him or herself when problems arise, identifying the kinds and sources of information the apprentice might need to find a solution, and pointing out important information or cues that the coach is relying on to guide problem solving.

Michael Williams, a biomedical technology apprentice at Lourdes Hospital, works two hours a day learning how to service monitoring equipment, life support devices, analytic equipment, and other machines used in the hospital. During his first year, Mike learned to test and repair the units, and he became aware of nontechnical aspects of his job, particularly the need for teamwork and responsibility. We observed Mike learning how to calibrate the heating element on a neonatal unit during one of his first weeks as an apprentice. With the housing removed to expose the unit's inner workings and a photocopied repair manual in front of them, Mike and his coach, Joe Ruby, worked together.

Explaining and Monitoring

Joe explains to Mike how to put the machine in a self-test mode. Then he continues to read aloud the directions in the manual, giving pointers in the process: "Make sure, if the power is off, to see that the needle is at 90. If not, you'd adjust it at this point."

Joe explains that different resistances programmed during these tests substitute for the temperatures of patients that would be recorded if a patient probe were connected to the unit. Over the next few minutes they test the resistance and internal calibration of several systems within the unit, including the temperature selector, the timer reset light, and the fluorescent lights.

After running several tests, Joe shows Mike how to set the calibration resistance box. He repeats the number of ohms so that Mike can get it right. He tells Mike to set the register for 3000. After Mike sets it, the register shows more than 3000.

Joe: "Sure that's 3000?"

Mike: "Yeah."

Joe points to the register to show the error. He then explains: "I always reset the register to 0000 before I start setting the register on new numbers so I'm sure where I start."

Mike resets the register to 0000 and tries again to set the correct number. He succeeds. Joe continues to call the numbers and Mike sets them on the register.

While they work, Joe gives Mike a bigger picture of the job. "We perform preventive maintenance to reduce unexpected breakdowns. We do it on all the equipment in the hospital to make sure things are running properly."

Although Mike gained considerable proficiency at these tasks, he was limited by not knowing the basic principles of electronics. After the observation, the manager of the department explained that his team had an instructional kit for basic electronics that could be set up for Mike. Some weeks later, Ben Wood and the department manager located an appropriate electronics course in an adult education program and negotiated with the school so Mike would not have to pay for it. On days when he attended the course, the hospital excused him from work but paid him.

Coaching about Computer Programs

Avion Fields, a health care apprentice at Binghamton General Hospital, worked in the medical records department for eight months. In the following account, a coach, Shirley Ross, explains how to perform a task correctly.

Avion works at the computer at his desk. His coach, Shirley, comes over and asks if he has a particular patient's file. He shows her where on the cart beside his desk he keeps the files for patients whose information he has not yet entered into the computer.

Shirley, finding the file: "This needs to be signed out. Do you know how to do that?" Avion shakes his head no. "I'll show you how to do it."

Shirley stands beside Avion, instructing him on what to type into the computer. First, she tells him how to exit the CRIS program and enter a different one used for the procedure. When she has reviewed the specific steps, she adds: "When we take a chart out we want to keep track of where it's going. Put the medical record number in." Avion reads the number from the chart and enters it into the system. "Put that code in, then hit escape. There, you're set."

Shirley explains not only the procedure but also why it must be followed. This incident is typical of coaching in that it was not a planned instructional unit but a lesson delivered as work proceeded to enable the apprentice to perform a larger share of the tasks.

Mentoring Apprentices

In contrast to coaching, which focuses on instruction about how to do technical job tasks, mentoring emphasizes social and personal aspects of work. The distinction between mentoring and coaching reflects recent analyses of workplace mentors. Business executives seeking mentors are advised not to choose an immediate supervisor because a mentor should be an advocate; a supervisor must sometimes make decisions that have a negative effect on a subordinate. Further, one function of a mentor is to provide a perspective that a supervisor may not have, to help a protégé figure out how to resolve conflicts with a supervisor, even to help bypass a supervisor in the organizational hierarchy. Hence we distinguish mentoring, as functions related to the social and personal sides of work, from coaching, which addresses the technical domain. There are three primary mentoring functions.

How employers mentor apprentices about social and personal aspects of work

Initiate the apprentice to the workplace culture. Apprenticeship brings adolescents into an adult social system, a new culture with its own rules, conventions, and norms. A mentor's explanations about the culture of the workplace facilitate the apprentice's adjustment to the work setting.

Advise the apprentice on career directions and opportunities. Career advice may be information about education and training requirements for a particular field, introducing apprentices to others who can share their experiences, or expanding the apprentices' conceptions of career domains.

Help resolve problems. A good mentor helps the apprentice resolve problems. Examples of problems are an apprentice not knowing how to ask for help or missing work because of a conflict at school or at home, and they may involve several systems (e.g., the firm, the school, and the apprentice's family).

Productive work in a sociotechnical system requires an understanding of social relations, not just the technical side of a job. Workers must be attuned to unwritten norms and traditions as well as written rules and procedures. Gaining this insight is especially challenging for an apprentice whose background culturally differs from those of most workers. Someone from a similar cultural background is more likely to be able to "read" the work situation and understand how to interpret and participate in social relations. Furthermore, apprentices who are like the other workers may well be mentored naturally by one or more experienced hands.

Without a formal process to assure that every apprentice receives mentoring, those who are unlike other workers in gender, race, language, or ethnicity may fail to adapt, not because of active prejudice but simply because no one thought to explain how things work. Following are some examples of mentoring that occurred during the project's first year.

Some young people need to be initiated into aspects of working life that seem obvious to most adults. Several had to be told, tactfully but firmly, that they must call and explain their absence if they could not come to work. Another had to be told that it was not appropriate to sit with his feet on the desk, which surprised him because at the fast food restaurant where he had worked before that was acceptable. Apprentices have also received advice about how to dress comfortably and safely at work.

Career advice came from a mentor who challenged an apprentice to take more advanced math and science courses to complement his work experience and prepare him for further education.

Another apprentice received advice on how to be a more reliable worker by dealing with health problems.

Apprentices' Responsibility for Learning

The coaching and mentoring functions listed on pages 11 and 13 entail complementary functions on the learner's part. In our observations of apprentices, we have noted a cycle repeated many times: apprentices begin by *observing* a coach perform a task; then they learn to *assist* with the task; finally they are able to *perform* the task, first *with assistance* and eventually *independently*. A difficult task may take months to master; a simple task may be learned in minutes or hours. A complex task may require mastering many small tasks. Apprentices perform the functions listed below.

How Apprentices Learn

Attend to coaching and mentoring. The first responsibility of a learner is to pay attention to instructions and observe demonstrations carefully, especially when accuracy and safety are required.

Try out or practice what has been taught. Learning does not occur solely by listening to and observing a coach; the learner must perform the behavior, and both the coach and the learner observe and evaluate that performance.

Process learning to comprehend, apply, and transform it. Processing connects new learning to knowledge, skills, and attitudes already present. An apprentice is processing learning when asking questions, altering what has been taught, trying a different approach, and adapting a skill to a new context.

Produce or get work done. The apprentice is expected to perform real work. If real work is not done well, the customer, the co-workers, and the firm suffer. The power of learning on the job is that it provides both the opportunity to apply what is learned and motivation to learn.

Initiate learning. An apprentice must learn how to learn, and that requires seeking out people who can teach and noticing opportunities for learning. Simply waiting for instruction as in a school classroom will seriously constrain learning.

Reflect on work experiences. Apprentices need to take time to think about their work experiences, to step back from their actions and focus on values, issues, and principles and on the long-term implications of their experiences.

Learning to Observe

Stacy Gorman's experience in the acute care section of the physical therapy department at Binghamton General Hospital illustrates how apprentices can enhance their own learning. Stacy had been an apprentice in the phlebotomy lab at Wilson Hospital during the fall semester and had been in physical therapy for one month when she was observed. The change required a significant adjustment in her role. In phlebotomy, she had drawn blood and otherwise participated actively in caring for patients. But physical therapists must have at least four years of college education and a New York State license because of the amount of knowledge required to plan and carry out a course of therapy. Without that knowledge and skill, Stacy was limited to observing the interactions between physical therapists and their patients, to assisting in routine exercises, and to helping with wheelchairs and other equipment, saving questions for a time when they were not intrusive.

Stacy is talking with a male patient stretched out on a table. He is exercising his leg following a double knee replacement. A physical therapist explains that the man might hurt his heel by rubbing it against the supporting board as he moves it. She takes the man's foot and asks Stacy for a towel, in which she wraps the foot, then fastens it with a rubber band. She gives the man a band that she loops around his foot and has him slide his foot up and down.

The patient's niece, who accompanies him to his therapy sessions, comments that Stacy is "so good," indicating that she has seen her several times.

Stacy moves over to the woman patient on the other side of the table who has also had knee replacement surgery. She has finished with her therapy. Stacy removes the board and places it with others in a storage area.

Later, during a lull in activity, I ask Stacy how she likes it in physical therapy.

She responds: "I like it a lot. I see patients three times a week if they are outpatients. I get to know them well. I am happy to see them."

I ask her what she is learning. (The dialogue is paraphrased.) She says, "All sorts of stuff. The patients have had knee and hip replacement surgery. We watched a knee replacement operation. We learn how the muscles and bones work and how to get them moving again."

She also described the adjustment in moving from the phlebotomy lab: "At the lab we were allowed to do a lot more. We are not allowed here because of regulations. It was hard to get used to that. I was so used to doing almost everything that everyone else did in the lab. But I have adjusted well, even though it took a while. The more time I spent here, the more I liked it and realized I don't have to do everything to learn."

I asked her what she learns from listening to the physical therapists talk to the patients. She replied: "I hear their clues and suggestions on how they can improve."

To learn in acute care, Stacy had to acquire different learning skills from those she used in phlebotomy. She was limited to providing routine assistance to physical therapists, and she listened to their explanations of therapy and observed treatments but had no knowledge or ability to do therapy herself. Although she would have preferred "acting like one of the staff," as she had in the lab, she made herself readily available to both coaches and eagerly did what they told her. She overcame her disappointment by learning to pay close attention to the physical therapists and to pose questions in her mind that they would answer later. (In the second year of the program, youth apprentices have been allowed to perform certain procedures in rehabilitation.)

Career Pathways

Below the professional level, the American labor market tends to be quite permeable in the sense that people can move easily from one occupational area to another. The absence of formal credentials for most occupations allows such movement, which gives great flexibility both to individuals and to the economy.

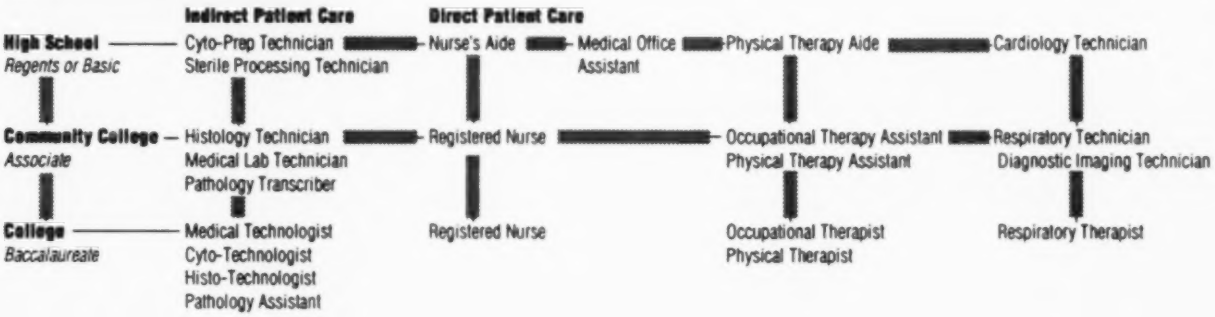
The drawback of a permeable labor market from the perspective of a young person is that it is relatively opaque. If it is unclear how to prepare for a particular job, planning for the future is difficult.

The labor market's opacity contributes to American young people's poor school performance and lack of responsibility. Because they cannot envision attractive career goals or how to attain them, too many dismiss school as unimportant and take risks (e.g., delinquency, drug use, inappropriate sexual behavior) that they might avoid if they had clearer goals. Youth apprenticeship makes the pathway from school to career transparent. A youth apprenticeship system must balance the competing goods of transparency and permeability. Formal credentials are critical to both. American youth would benefit from greater transparency even at the cost of some permeability as specific certification requirements are added to occupations that in the past have had none. The youth apprenticeship announcements illustrated below and on the next page give examples of career pathways.

Lourdes Hospital

Career Pathways *—Health Care / Patient Care*

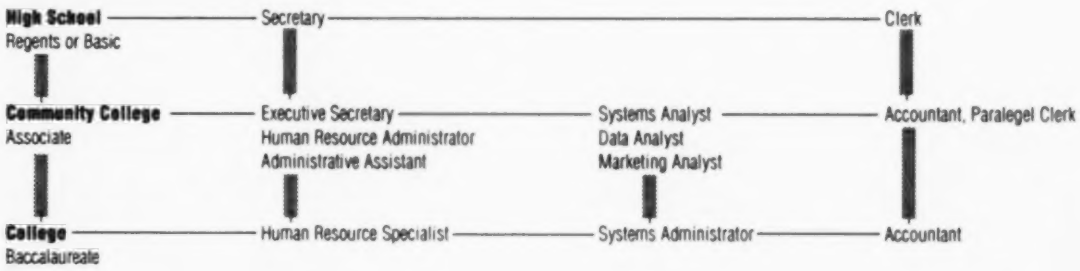
What does this apprenticeship lead to?



The Raymond Corporation

Career Pathways *—Administration and Office Technology*

What does this apprenticeship lead to?



Youth Apprenticeship Announcement

Title: Manufacturing and Engineering Technology **Openings: 4**

Where? **IBM Corporation**
1701 North Street
Endicott, NY 13670

IBM Endicott manufactures a variety of products including computer processors, printers, banking systems and circuit packaging. In the future, as in the past, IBM Endicott will be deeply involved in the technologies shaping tomorrow. IBM is committed to the education of America's youth in order to help them fulfill their potential and to maintain a competitive workforce for our company and the nation.

Time? Apprentices will work mornings, Monday through Friday, 3-4 hours per day, 15-20 hours per week. Start times are flexible and will be defined at the time of assignment. Employment continues through the summer.

How do you apply? Contact the Apprenticeship Coordinator at your school for application procedures and further information.

What would you do? Apprentices participating in the program will be trained in many areas of manufacturing. Initially, heavy emphasis will be on the operation of manufacturing equipment producing basic computer components. This involves loading and unloading process machinery and monitoring equipment for proper operation. The equipment includes chemical apply machines, etchers, bake ovens, etc. With experience, apprentices will learn overall process flow and quality control.

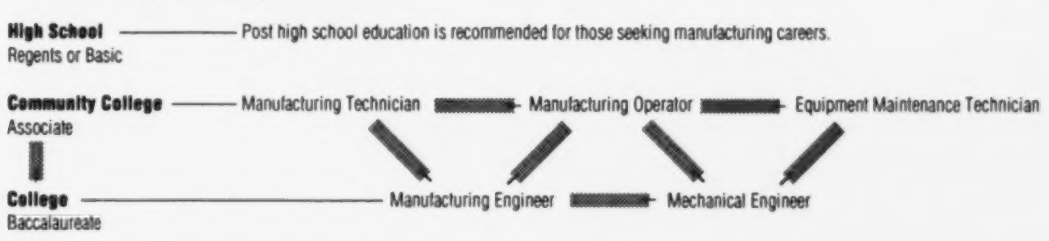
What will you learn? The apprentice will learn technical skills including: manufacturing equipment operation, product flow through a manufacturing facility, statistical process control, and inspection techniques. Social skills include teamwork, responsibility, and commitment to excellence.

What other rewards will you receive? Hourly rate to be communicated at the time of interview.

What qualities will we look for in applicants? Students must have a high level of interest in hands-on manufacturing operations in a team oriented environment. Flexibility toward different assignments is essential. Keyboarding skills are a plus and student must be reliable with regard to attendance.

Career Pathways *—Manufacturing and Engineering Technology*

What does this apprenticeship lead to?



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Youth Apprenticeship Demonstration Project
Cornell Cooperative Extension, June 8, 1992

Managers Cross-Train Health Care Apprentices

David Tolomei, a health care apprentice at Lourdes Hospital, mastered various technical procedures related to lab work in the cytology and histology divisions of an anatomical pathology lab. He learned to access specimens; centrifuge specimens; embed tissue; do cytospin preps, including slide fixes, stains, coverslips, labels, and deliveries; clean and maintain the work area and the instruments; and restock supplies. His ability to perform efficiently and effectively tasks normally performed by technician-level staff led the hospital administration to hire him for additional hours in the spring and summer months to offset shortages in lab personnel.

Yet his success caused lab managers Barbara Dundon and Bill Balbuena as well as administrators to question the long-term direction of his learning program and how it meshed with career paths within the hospital's health care apprenticeships. Although he could meet productive worker standards on the tasks he had mastered, David's managers and coaches continued to introduce him to new procedures. His curiosity constantly suggested new directions within the lab, which was exciting for the coaches and the apprentice, but they wondered if his educational interests might be better served by going to another department to explore other career possibilities and his own interests in new contexts.

Should apprentices learn to perform a limited number of tasks within one department and then enter into productive work? Or should they learn additional procedures, systems, and principles working in several departments?

During an interdepartmental meeting about their colleagues' experiences in different departments, managers quickly identified relationships among the tasks apprentices engaged in and the competencies they developed. Rather than looking at apprentices as belonging to their departments, they began to see them as learning from many departments within the hospital. Managers agreed that all apprentices would benefit from a rotation through three different departments during their first year and a half to learn basic technical as well as social competencies such as teamwork, responsibility, and communication skills. Some would branch off, specializing in technical procedures related to particular departments, such as occurred with David in lab techniques, and this would be encouraged.

Todd Switches Career Paths

At The Raymond Corporation, **Todd Flanagan,** an apprentice in manufacturing and engineering technology, made an unusual change in career direction. The firm's training director, Steve Pecararo, noticed that he was not thriving and spoke with him about his dissatisfaction and about his goals. Todd had applied for manufacturing because he wanted to do something with his hands, but he had previously known only farm work and he found electrical subassembly boring. He discovered that office work was personally satisfying, and his priority became to learn how to do it well and make a successful career in it.

Todd switched to an apprenticeship in administration and office technology. He began working in the marketing department, where he learned about computers and research. After a few weeks in his new location, Todd said he liked working in an office better than on the factory floor. The experience with computers and research projects gave him confidence in his ability to learn.

One of Todd's projects involved market research about competitive fork lift trucks. He learned to input data using Lotus 1-2-3. His coach, Cindy Dudra, helped unravel a complex research task by showing him how to use spreadsheets to compare specifications for the trucks. Todd admitted that the work was sometimes tedious, but he liked gaining a broader view of how this work fit into world markets. He also learned firsthand how to break data into manageable chunks and knew that eventually he would be able to create spreadsheets for future research problems.

The program allowed Todd to change directions while increasing his skills and self-confidence. He was fortunate that The Raymond Corporation offered apprenticeships in two areas and that Steve was sensitive to his developmental needs and willing to tailor the program to meet his needs.

School-Based Curricula

Special Projects

Apprentices are divided among too many schools and too many different occupations for us to offer classes especially for them. Therefore, the major change in school practice has been the addition of special projects, extended academic activities in which a youth apprentice explores in depth an issue of importance at work. For example, a health care apprentice might investigate the handling of toxic wastes. This approach was borrowed from Sweden and introduced in a series of three afternoon workshops for teachers, counselors, and administrators from participating schools. At least one academic teacher is responsible for working with each apprentice on the special project. A coach in the workplace also provides supervision. The project will culminate in a formal presentation comparable to the exhibitions used by the Coalition of Essential Schools.[5]

Sample Topics for Special Projects

Are computers and robots taking over?

- What will be left for people to do?
- How can we retrain workers displaced by technology?
- How does working with computers affect socialization?

How do teams work?

- How do teams function in two departments?
- How do they divide the work?
- How is teamwork different from in the past and how it is done in other countries?

What happens to patients who cannot pay medical costs?

- What could be done nationally?
- How do programs in other countries solve this problem?

How do anatomical pathologists use autopsies to solve mysteries?[6]

5. See Theodore R. Sizer, *Horace's School: Redesigning the American High School* (New York: Houghton Mifflin, 1992).

6. This topic was suggested by Bill Balbuena, a workplace coach and mentor. High school teachers generated the preceding topics during a series of three half-day workshops designed to prepare for increased school-based curricular links to apprenticeships.

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Advisory Group

Beginning in 1992–93, apprentices in each school meet in advisory groups led by a teacher or counselor to engage in discussion, receive guidance about personal and social behaviors in the workplace, and share problems and achievements at work. We expect that behavioral norms in the workplace will be a key issue in advisory groups. Several first-year apprentices discovered that if they were to meet work demands, they had to become more punctual and more mature. Advisory groups will help them identify and cope with such demands.

The groups also encourage critical reflection on work experiences. To understand the world around them, young people need help in thinking through what they have seen and done. Talking with others in similar situations can be especially helpful. The advisory group leader might, for example, ask, "What does it mean to be a good worker in your workplace?" Apprentices' responses will raise issues about how competence is defined, recognized, and acquired that they will need to understand to become good workers themselves.[7]

Courses

Along with special projects and advisory groups, courses to complement work-based learning will eventually constitute a third component of the school-based curriculum. These courses may be taught at the high school or at adult and continuing education institutions, especially Broome Community College (BCC). Such courses have not yet been available to apprentices except on an ad hoc basis, such as an adult education electronics course that one apprentice took.

As a regional institution with courses and programs in all three of the project's occupational areas, BCC is ideally placed to provide specialized classes for apprentices. Most will attend BCC after graduation from high school. Representatives of BCC have participated in the project steering committee from the beginning. Now they are helping to orient apprentices and identify appropriate courses and programs.[8] It may

Advisory Groups

Possible Meeting Topics

- Competencies: Workplace rules, organizational systems, teamwork, communication skills, responsibility, excellence
- Ethical dilemmas arising in the workplace
- Local issues related to apprentices' work and interests
- How to be an effective learner in the workplace
- Issues of gender, race, and power

Possible Activities

- Keeping a journal, publishing a newsletter
- Meeting outside speakers
- Acting out workplace dilemmas, debating issues
- Videotaping
- Interviewing
- Reading articles and segments of apprentice journals

7. "Reflection" is a key word for us. John Dewey said that reflection is what makes experience educational. A new book, *Learning Work: A Critical Pedagogy of Work Education*, by Roger I. Simon, Don Dippo, and Arleen Schenke (Toronto: OISE Press, 1992), contains much useful advice for teachers on how to help high school students learn about work, as distinct from learning how to work, which is what happens on the job.

8. One issue that has arisen in this process has been the need to assure that vocational-technical programs are sufficiently broad to convey fundamental principles and to enable apprentices to continue their education after receiving a two-year degree. We have learned, for example, that graduates of a two-year program leading to certification as a physical therapy assistant receive advanced credit only if they have selected broader scientific courses acceptable in a four-year program to become physical therapists.

become possible for some apprentices to take a college course while still in high school. Another approach to providing specialized courses to apprentices who are still enrolled in high school is to create career academies, schools within schools organized around occupational issues. Participating schools have expressed interest in establishing career academies, notably in health and bioscience.

School Coordinators

A school coordinator orchestrates support for the program within each of our member schools. These key contacts are appointed and supported financially by their school districts: three are guidance counselors, one is a vice-principal, one is an occupational arts teacher, and one is a special projects coordinator for a high school. This year, school systems with nine or more apprentices allocated specific percentages of school coordinators' time to responsibilities related to the project. All six coordinators communicate with firms and parents, work with guidance counselors on scheduling, develop recruiting systems, and encourage school-based curricular links.

How School Coordinators Promote Apprenticeships

- Coordinate school committee to advise on program development and operations.
- Promote school-based curriculum development, such as advisory groups, special project teams, and academic connections.
- Recruit candidates for apprenticeship openings.
- Link apprentices to guidance about careers and education.
- Communicate with parents and employers as needed.

An Exemplary School Coordinator

Margaret Coffey organized assemblies with apprentices, guidance counselors, and teachers last spring at Binghamton High School to inform sophomores about the apprenticeship program and to recruit applicants for the next school year. These spring recruiting events exemplify how Margaret, an energetic school coordinator, promotes apprenticeship. She skillfully connects existing systems and creates new systems to enable the program to develop throughout the school.

Among her activities are convening an apprenticeship school committee monthly for advice and direction on next steps to support the program; urging guidance counselors to examine apprentices' schedules for time as well as course selection; and encouraging union negotiators and the administration to approve flextime for an advisory group leader. She also pilots roundtable meetings to inform members of the community and state about program operations, while economizing time spent by faculty, parents, students, and employers.

Margaret moves quickly through crowded hallways between classes, addressing many students by their first names and engaging in brief conversations with some. She seeks out apprentices to follow up issues that may have arisen and connects them with appropriate faculty who can help resolve questions. She encourages seniors to ask teachers to join their special project team. As an advocate she strives to create challenging programs for all youth.

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Institutional Base

Cornell University and Cornell Cooperative Extension have provided an institutional base that bridges school, work, and families for the demonstration project. As it evolves into a permanent system, however, it will need an institutional base in which all parties play a role. European apprenticeship systems are operated by joint committees including employers, educators, and organized labor. In Germany, they are convened by chambers, which are employers' organizations. Denmark has free-standing Trade Committees that perform the same functions.

One question to be answered in the United States is whether to invent a new institution to perform these functions or to assign them to an existing institution. New institutions need time and resources to establish themselves, but old institutions carry an image and a history that can impede as much as aid their effectiveness. Project staff are currently identifying the functions that must be performed and the interests of each party.

Defining Occupational Areas

Youth apprentices should be prepared to perform all the tasks associated with a broadly defined occupational area. This goal contrasts with conventional U.S. practice of defining jobs narrowly; however, it is consistent with the trend in high-performance work organizations for workers to have many skills and to be capable of continuing to learn throughout their careers. A balance must be struck between depth and breadth. Superficial exposure is not enough. Short periods of time in each placement within a firm prevent an apprentice from becoming genuinely productive in any department, but if specific job descriptions are the targets, then a long-term intensive apprenticeship is unnecessary. Only by gaining both breadth and depth will young people be prepared for the demands of the future and be flexible enough to pursue changing career interests.

Health Care

The health care work force will grow in coming years, creating career opportunities for young people. Those opportunities are diverse, spanning the entire range of the occupational hierarchy. Hospitals employ orderlies and food servers as well as physicians and managers. Moreover, the need to provide efficient health care has increased the number of middle-level technicians, opening opportunities at precisely the level best served by youth apprentices. Health care is not only a growth industry; it is also one of the few industries that continues to thrive in central cities as manufacturing moves out and offshore. Discovering how to design health care programs is, therefore, crucial to the goal of establishing youth apprenticeship in large cities.

There are, sadly, some major barriers to overcome along the way, notably the strong separation among health care occupations. Some separation is logical. In addition to the many people who provide direct care to patients, there are others whose work supports patient care indirectly. Hospitals need plumbers and electricians, accountants and managers with the same skills as those of their counterparts in other organizations. These needs are reflected in our hospital-based apprenticeships in administration and office technology, such as in medical records and finance at United Health Services Hospitals, and in the manufacturing and engineering technology apprenticeship at Lourdes Hospital focused on maintaining electronic equipment. Except for their location in a health care organization and their ultimate contribution to patient care, these occupations have little in common with those devoted to patient care.

Apprentice Progress Report, 1992-93, United Health Services Hospitals

Technical Competencies: Perform work tasks

1. Procedures: Follow steps to accomplish a task	**S**	**U**	**NA**
Health Care:			
1.1 Respond to patients in a respectful, caring manner			
a. Respect patients' dignity			
1.2 Organize work tasks			
a. Meet productivity standards			
1. Organize time productively			
2. Use free time productively			
3. Identify administrative procedures required for efficient execution of treatment			
4. Maintain work area in manner conducive to efficiency			
b. Report status of tasks			
c. Recognize an unusual occurrence and respond accordingly			
1.3 Assist with office management			
a. Answer phone in a professional manner			
b. Take messages correctly (relay in timely manner)			
c. Perform courier duties			
d. Copy files when needed			
e. Type when needed			
1.4 Call, prepare, dismiss patients			
a. Introduce self to patient			
b. Take patient to room for procedure			
c. Direct patient to change clothes			
d. After procedure, direct patient how to exit area			
1.5 Maintain records/files			
a. Assist daily charge system			
b. Compile patient chart			
c. Pull studies for comparison			
d. File data (slides, cards, reports)			
1.6 Clean and disinfect work stations			
1.7 Transport patients			
a. Collect patient belongings and transfer them with patient to designated unit or department			
b. Safely transport patients			
1. Siderails in up position			
2. Safety straps in place			
c. Assist nursing staff in transfer of patient:			
1. From stretcher or wheelchair			
2. Into hospital bed			
3. Locks and brakes in place			
f. Demonstrate appropriate use of 2 way radio			
g. Appropriately follow instructions from dispatcher			
h. Demonstrate knowledge of documentation guidelines for transports			

Physical Therapy:	S	U	NA
1.8 Perform planned treatment programs with patients as outlined by therapist			
a. Have basic understanding of total hip replacement exercise protocol			
b. Have basic understanding of hip fracture exercise protocol			
c. Have basic understanding of total knee replacement exercise protocol			
d. Utilize positioning and treatment sequencing to foster desired patient response			
e. React to change in patient's status in a given treatment session (report to therapist)			
1.9 Observe therapist interactions with patient			
1.10 Understand apprentice's legal limitations under NY State Physical Therapy Practice Act, and what legally able to do			
a. Cannot do modalities			
b. Cannot put hot pack on a patient			
c. Responsible to get authority to make decisions, and to speak up and say: "I'm sorry, I can't do that" if asked to do procedures not permitted to do			
1.11 Create a comfortable environment for the treatment of the patient			
a. Provide blankets, water, proper draping			
1.12 Perform safe transfer techniques as instructed by therapist			
a. Use appropriate DME, and/or braces, transfer devices as instructed by therapist			
b. Transport patient in a timely manner according to expectations (No greater than 5 minutes for 85–95% of transports)			
c. Notify therapist of transport delays or cancellations			
1.13 Follow housekeeping procedures and standards			
a. Clean equipment appropriately following use and/or at the end of each day			
b. Follow Infection Control Policy			
c. Participate in maintaining clean and safe environment in clinic area			

	S	U	NA
1.14 Demonstrate knowledge of Infection Control Policy			
a. Read and initial policy twice per year			
b. Provide input on Infection Control Study Quarterly			

Comments:

Phlebotomy Laboratory:

1.15 Perform basic phlebotomy			
a. Call in and greet patients			
b. Confirm patient ID			
c. Do patient intake			
d. Decipher and comprehend doctor's orders			
e. Categorize orders STAT vs. routine			
f. Enter test orders into computer			
g. Prepare and label tubes; prepare specimen containers			
h. Perform basic phlebotomy			
i. Deliver specimens			
1.16 Follow office procedures (standing orders, patient returns)			
1.17 Follow MOA office procedures			
a. Register patients into hospital computer system			
b. Enter tests			
c. Pick up specimens throughout hospital			
d. Perform receptionist duties in lab			
1. Direct patients to departments within lab			
2. Give reports over phone to doctors' offices			
1.18 Demonstrate proper blood and body fluid precautions			

Comments:

Even among patient care occupations that share both a common purpose and a common knowledge base, however, divisions have grown up that impede apprenticeship. We learned, for example, that physical therapy assistants, who have been certified through a two-year community college program, become physical therapists after they take a four-year program, but such programs may not recognize their previous training. Such narrowness and rigidity pose a serious problem in a program designed to take youth apprentices through a two-year degree program but also to lay a foundation for further education and training thereafter. We are committed to steering our apprentices away from dead-end career paths.

Regulations designed to protect patients, combined with professional standards promulgated by occupational associations, restrict who can perform certain medical procedures. Apprentices in physical therapy, a very popular choice, are not allowed to perform certain procedures because they lack the required courses and license. Courses and school-based certificates are frequently specified, rather than performance-based assessments. (Some flexibility was introduced into the physical therapy apprenticeship during the second year, when apprentices formally became employees of the hospital, which placed them under the protection of liability insurance.) It would be ironic if hospitals, which take great pride in training their most highly skilled workers—physicians—via a process similar to apprenticeship, resisted introducing internships or apprenticeships for middle-level workers.[9]

Much health care work is the same regardless of the location where it is performed. This should make it easier to identify universal competencies and to organize them into modules that may be learned in any participating organization and then be recognized by other health care providers.

Administration and Office Technology

This occupational area is relatively undeveloped below the levels at which four-year degrees are required. Secretarial training is a staple of secondary and postsecondary vocational education programs, but people engaged in secretarial work have a wide range of credentials. Bookkeeping and accounting are relatively well-established specialties. But many administrative functions—purchasing is an example—are performed by

9. Until the turn of the century, when Abraham Flexner brought to the United States the German institution of research-based graduate medical schools, most American physicians learned their trade literally as apprentices.

Apprentice Progress Report, 1992-93, Security Mutual

Some Technical Competencies in Administration and Office Technology

2. Computer Use: Use computer technology efficiently and effectively	**S**	**U**	**NA**
2.1 Master basic computer skills			
a. Handle/store disks			
b. Boot machine			
c. Input data			
d. Store data			
e. Retrieve data			
f. Print reports (understand printer)			
g. Shut off machine			
h. Format disks			
i. Copy disks			
j. Generate labels for disks			
k. Know keyboarding			
2.2 Use software (understand specific functions)			
a. BLASE (SSI Pension System)			
b. PROFESSIONAL WRITE			
c. MORTGAGE SYSTEM			
d. Computer Terminal Information data			
e. DATA-BASE			
f. FOX-PRO			
2.3 Access mainframe			
a. Log on			
b. Extract information			
c. Log off			
2.4 Use LOTUS 1-2-3			
a. Use spreadsheets			
b. Create spreadsheets, set up			
c. Work on budgets			
d. Manipulate data with calculations			
2.5 Calculate			
a. Rates			
b. Valuations			
c. Terminations			
d. Amendments			
e. Restatements			

3. Principles: Understand reasons for procedures S U NA

3.1 Understand workplace ethics, codes of behavior

3.2 Understand importance of department's work

a. Goals and functions
b. Relationship of task to client
c. Adverse effects of incorrect information

3.3 Understand document purposes

a. Types of records
b. Products
c. State regulations

3.4 Understand basic accounting

a. Purchase distribution
b. Check register
c. Journal entries
d. Account numbers and their definitions
e. Taxation
f. Terminology (e.g., discounts, leasing, calculate, valuations, terminations, amendments, restatements)

Comments:

4. Excellence: Commit to high standards of practice and to continuous improvement

4.1 Commit to professional ethics

a. Be trustworthy and honest

4.2 Commit to professional behaviors

a. Be efficient
b. Ask questions in timely fashion
c. Adhere to dress code (hygiene, style)
d. Commit to accuracy at all levels (Quality Control)
   1. Check information (e.g., input, feedback, reports)
   2. Handle products properly
   3. Maintain study/specimen integrity (label correctly)
e. Report problems, discrepancies, etc.
f. Acknowledge need for accountability (follow procedures)

4.3 Respond to suggestions for improvement; seek and accept constructive criticism

d. Know what to do if you have a problem, a jam, etc.

Comments:

people with no specific preparation, whose career paths may include other unrelated positions.

Ideally, American youth apprentices in administration and office technology would be broadly trained, acquiring exposure to and skills in a range of tasks as a foundation for later specialization.[10] Such breadth would make them flexible and able to adapt to organizational and technological change, although this is a difficult idea for most employers to understand because it is so different from the way they now think about administrative careers. Such broad training requires that all apprentices receive extensive school-based education so that they have the tools to work productively and can be more than unskilled helpers at work.

Manufacturing and Engineering Technology

Manufacturing is changing rapidly in response to new technology and unremitting competition. The key question about manufacturing and engineering occupations is how to define them broadly enough so that they will not be outmoded within a few years. Breadth is also required in the competencies associated with occupations. No one can expect any more to use the same technical skills throughout a lifetime career. For all occupational areas, therefore, generic social and personal competencies such as ability to work as part of a team and capacity for lifelong learning must be combined with broad technical knowledge and skills that build on basic academic subjects, especially math and science.

As in the other occupational areas, a challenge we face is to create apprenticeships that are equally appropriate in many different workplaces. This requires that many employers agree on the definition of broad occupational titles within the area and identify required competencies. The following examples of firms that have redefined occupations make the case

10. The German-speaking countries combine all these and other middle-level administrative occupations under the general title *Kaufmann*, which can be translated as merchant. (*Mann* makes the word masculine, although it is also applied to women. The feminine form is *Kauffrau*. The neuter plural word is *Kaufleute*.) Rather than dividing administrative occupations by function, as is done in the United States, the Germans divide them by sector of the economy. Thus middle-level white-collar employees go through different apprenticeships if they plan to work in manufacturing, banking, real estate, retail trade, insurance, and so on. Switzerland does not make this sectoral distinction in its apprenticeship program, providing the same schooling for all; sectoral specialization occurs at the workplace.

for keeping occupational titles broad.

Asea Brown Boveri (ABB), a Swiss/Swedish multinational manufacturing firm, restructured its apprenticeship training in response to the new requirements of Computer Integrated Manufacturing (CIM). Drafting, machining, and electronics technology were combined into a comprehensive program. New apprentices spend their first two years learning about all three areas equally. During their third and fourth years they specialize in one area but continue to acquire work experience in another. For the purposes of the national (Swiss) system, they qualify as skilled workers in one of the occupations, but they are well suited to high-tech manufacturing because in addition they have solid grounding in the other two areas as well. Such breadth enables skilled workers to perform a wider range of tasks, to work closely with specialists in other areas, and to learn new technologies and new production methods quickly. It also gives them more career options because they can change specialties relatively quickly.

Responding to the same currents of change, IBM in Austin, Texas, has created a new training program for manufacturing technical associates, which includes computer use, statistical process control, chemistry, maintenance, problem solving, writing, and a range of other subjects. Cooperation with Austin Community College enables some workers to earn associate's degrees while earning this occupational title.

These are models for the program we hope to develop in manufacturing and engineering technology. Our progress in this direction is limited, however, both by our own limited resources and by the need to involve representatives from many firms in identifying the occupational areas and associated competencies and then translating that into curricula for school and workplace.

Restrictive Rules and Regulations

Labor laws restrict young people's working hours and their exposure to occupational hazards. Youth apprenticeship requires no relaxation of laws and regulations that shield young people from real dangers. But the dispersal of laws and regulations across multiple statutes (state and federal) and sometimes multiple agencies, combined with the ambiguity introduced by varying interpretations and enforcement practices, all combine to create uncertainty among employers about what they can allow youth apprentices to do. If they become registered apprentices, much of this ambiguity disappears. If they are categorized as student learners, it is also lessened. The ideal solution is to do as Wisconsin has done and define youth apprenticeship in the law, setting out explicitly what laws and regulations apply. This is one step that state governments and the federal government could take to clear the way for youth apprenticeship.

Conclusion

The publication of this report coincides with the inauguration of a new president who has promised to support youth apprenticeship. This is an exciting prospect but a daunting one too because so much remains to be learned about how to transform a good idea into a viable system. Everyone who is committed to improving the transition of adolescents into adulthood must be prepared to share experiences and analyses and to debate thoughtfully how to build a youth apprenticeship system. We hope our report contributes to that process.

For More Information

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